Case Study
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STATISTICAL STUDY OF CHANGE IN HUMAN LIFESTYLE AFTER COVID-19: A CASE STUDY

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ABSTRACT

This research article studies the change in human lifestyle after Covid–19 pandemic. We have conducted an online sample survey about various factors associated with human life after the COVID-19 pandemic. After this survey, we have classified responses into various categories, especially infected and non-infected by COVID–19. We test whether various human lifestyles in all respondents are divided into the ratio 1:1 or more proportion belonging to the specified human lifestyle. We also compare the proportions of various human lifestyles in infected and non-infected categories. We compute the Z-statistic to test the statistical significance of these proportions of human behaviors. p–values are obtained for each of these tests, which helps us to know how much the observed value of Z-Statistic is significant for rejecting the null hypotheses about various human lifestyles. p–values are probabilities, which always take values between 0 to 1. The smaller p-value supports rejecting the null hypothesis in favor of its alternative, whereas the larger p–value supports accepting the null hypothesis.

Keywords: COVID-19, Human Lifestyles, Infected and Non-Infected, Fear of Health and Source of Income, Food Habits, Preference for Residence, Practice of Yoga and Physical Exercise, Hypothesis, Z–Statistic, p–Value

1. INTRODUCTION

A pneumonia of unknown cause detected in Wuhan City, China and it was first reported to the World Health Organization (WHO) Country Office in China on December 31, 2019. The outbreak was declared a Public Health Emergency of International Concern on January 30, 2020 by WHO. On February 11, 2020, WHO announced a name for the new corona virus disease as COVID -19. First fatality due to Covid-19 also occurred in Wuhan City, China. In India, first COVID -19 infected patient found in Thrissur, Kerala on January 30, 2020 and its first fatality found in Kalburgi, Karnataka on March 13, 2020. Patil (2020). As on June 1, 2022, India

reported a total of 43,847,065 confirmed cases, with 525,930 deaths. These figures for The World are 564,126,546 and 6,371,354 respectively. COVID–19 Situation Update Report–116 (2022, July 22). Many researchers have studied impact of COVID –19 on human lifestyle in various perspectives. Ting et al. (2021), Mirza et al. (2020).

In this research article we study change in human lifestyle after COVID –19 pandamic. We have conducted online sample survey about various factors associated with human life after COVID –19 pandemic. Questionnaire consists of a set of questions related to the change in lifestyle before and after COVID –19 for the purpose of gathering information from respondents. This online survey is conducted in the month of February 2022 through Google Forms. After this survey, we have classified responses into various categories, especially infected and non-infected by COVID–19. We test whether various human lifestyles in all respondents are divided into the ratio 1:1 or more proportion belonging to the specified human lifestyle. We also compare the difference between the proportions of various human lifestyles in infected and non-infected categories. We compute Z–Statistic for testing the statistical significance of these proportions of human behaviors. p–values are obtained for each of these tests, which helps us to know how much the observed value of Z-Statistic is significant for rejecting the null hypotheses about various human lifestyles. p–values are probabilities, which always take values between 0 to 1. The smaller p-value supports the rejection of the null hypothesis in favor of its alternative, whereas the larger p–value supports to acceptance of the null hypothesis.

2. METHOD OF STUDY

This study is mere data oriented and as we mentioned in introduction, primary data is collected. Though data is collected through Google Form, we realized that most of the respondents are from Kolhapur District, Maharashtra State, India. 80 individuals are responded for questionnaire, out of these 80, 12 were infected by COVID -19, 48 non-infected and remainings 20 were not realized whether they infected or not by Covid–19. Further, we classify data into various lifestyle behaviours of respondents.

We test whether various human lifestyles in all respondents are divided into the ratio 1:1 or more proportion is belonging to the specified human lifestyle by using Z-Statistic and it is given by

$$Z_{Cal} = \frac{\sqrt{n}(\hat{p}-0.5)}{\sqrt{\hat{p}(1-\hat{p})}} \rightarrow N(0,1)$$

where,

$\hat{p} = \frac{X}{N}$: Proportion of respondents with specified lifestyle,

X: Number of respondents with specified lifestyle,

N: Total number of respondents.

Also, we test the hypotheses of equality of proportions of individuals for various lifestyle behaviours into infected and non-infected classes by using Z-Statistic and it is given by

$$Z_{Cal} = \frac{(\hat{p}_1-\hat{p}_2)}{\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}} \rightarrow N(0,1)$$

where,

$\hat{p}_k = \frac{X_k}{n_k}$: Proportion of respondents with respect to some lifestyle behaviour into k[th] class,

X_k: Number of respondents with respect to some lifestyle behaviour into k[th] class,

n_k: Number of respondents into k[th] class.

k = 1 (Class of individuals infected by Covid–19) and

k = 2 (Class of individuals non-infected by Covid–19)

and $\hat{p} = \frac{X_1+X_2}{n_1+n_2}$.

Also we obtain p-value of observed Z-Statistic, which will be used to judge the statistical significance of the difference between lifestyle behaviour of respondents into infected and non-infected classes. We represent this further classified data, observed Z-Statistic for various lifestyle behaviours and its p-value into tabular form as below.

Table 1

Table 1 Classification of Respondents with Respect to Food Habit: Vegetarian and Non-Vegetarian

	Vegetarian	Non-Vegetarian	Total
Infected	2	10	12
Non-infected	17	31	48
Total	19	41	60

Testing of Hypotheses:

H_{01}: p = 0.5 against **H_{11}**: p > 0.5 where,

p = Praportion of vegeterian individuals from all respondents.

H_{02}: $p_1 = p_2$ against **H_{12}**: $p_1 \neq p_2$ where,

p_1 = Praportion of vegeterian respondents in Infected class.

p_2 = Praportion of vegeterian respondents in Non-infected class.

Table 2

Table 2 Computation Summary for Testing H_{01} and H_{02} by using Data in Table 1

Hypothesis	Praportions	Z-Statistic	p-value
H_{01}	p = 0.3167	-6.5647	1.0000
H_{02}	p_1 = 0.1667	-1.2488	0.2117
	p_2 = 0.3542		

Table 3

Table 3 Classification of Respondents with Respect to Yoga Practice: Always, Sometimes and Not at all

	Always	Sometimes	Not at all	Total
Infected	0	9	3	12
Non-infected	13	28	7	48
Total	13	37	10	60

Testing of Hypotheses:

$\mathbf{H_{01}}$: p = 0.5 against $\mathbf{H_{11}}$: p > 0.5 where,

p = Praportion of individuals practicing Yoga at least sometines from all respondents.

$\mathbf{H_{02}}$: $p_1 = p_2$ against $\mathbf{H_{12}}$: $p_1 \neq p_2$ where,

p_1 = Praportion of respondents practicing Yoga at least sometines in Infected class.

p_2 = Praportion of respondents practicing Yoga at least sometines in Non-infected class.

Table 4

Table 4 Computation Summary for Testing H_{01} and H_{02} by using Data in Table 3

Hypothesis	Praportions	Z-Statistic	p-value
H_{01}	p = 0.8333	6.927	0.0000
H_{02}	p_1 = 0.7500	-0.8662	0.3864
	p_2 = 0.8542		

Table 5

Table 5 Classification of Respondents with Respect to Physical Exercise: Always, Sometimes and Not at all

	Always	Sometimes	Not at all	Total
Infected	3	9	0	12
Non-infected	27	20	1	48
Total	30	29	1	60

Testing of Hypotheses:

$\mathbf{H_{01}}$: p = 0.5 against $\mathbf{H_{11}}$: p > 0.5 where,

p = Praportion of individuals doing physical exercise at least sometines from all respondents.

$\mathbf{H_{02}}$: $p_1 = p_2$ against $\mathbf{H_{12}}$: $p_1 \neq p_2$ where,

p_1 = Praportion of respondents doing physical exercise at least sometines in Infected class.

p_2 = Praportion of respondents doing physical exercise at least sometines in Non-infected class.

Table 6

Table 6 Computation Summary for Testing H_{01} and H_{02} by using Data in Table 5

Hypothesis	Praportions	Z-Statistic	p-value
H_{01}	p = 0.9833	29.214	0.0000
H_{02}	p_1 = 1.0000	0.5029	0.6150
	p_2 = 0.9792		

Table 7

Table 7 Classification of Respondents with Respect to Health Consciousness: Increased, Decreased and No change

	Increased	Decreased	No change	Total
Infected	8	1	3	12
Non-infected	30	9	9	48
Total	38	10	12	60

Testing of Hypotheses:

$\mathbf{H_{01}}$: $p = 0.5$ against $\mathbf{H_{11}}$: $p > 0.5$ where,

p = Praportion of individuals with increase in Health Consciousness from all respondents.

$\mathbf{H_{02}}$: $p_1 = p_2$ against $\mathbf{H_{12}}$: $p_1 \neq p_2$ where,

p_1 = Praportion of respondents with increase in Health Consciousness in Infected class.

p_2 = Praportion of respondents with increase in Health Consciousness in Non-infected class.

Table 8

Table 8 Computation Summary for Testing H_{01} and H_{02} by using Data in Table 7

Hypothesis	Praportions	Z-Statistic	p-value
$\mathbf{H_{01}}$	$p = 0.6333$	2.1426	0.0161
$\mathbf{H_{02}}$	$p_1 = 0.6667$	0.2613	0.7939
	$p_2 = 0.6250$		

Table 9

Table 9 Classification of Respondents with Respect to Fear: Health, Source of Income, Both and Not at all

	Health	Source of Income	Both	Not at all	Total
Infected	3	0	7	2	12
Non-infected	23	3	12	10	48
Total	26	3	19	12	60

Testing of Hypotheses:

$\mathbf{H_{01}}$: $p = 0.5$ against $\mathbf{H_{11}}$: $p > 0.5$ where,

p = Praportion of individuals with Fear of at least Health or Income from all respondents.

$\mathbf{H_{02}}$: $p_1 = p_2$ against $\mathbf{H_{12}}$: $p_1 \neq p_2$ where,

p_1 = Praportion of respondents with Fear of at least Health or Income in Infected class.

p_2 = Praportion of respondents with Fear of at least Health or Income in Non-infected class.

Table 10

Table 10 Computation Summary for Testing H_{01} and H_{02} by using Data in Table 9

Hypothesis	Praportions	Z-Statistic	p-value
H_{01}	p = 0.8000	5.8095	0.0000
H_{02}	p_1 = 0.8333	0.3222	0.7473
	p_2 = 0.7917		

Table 11

Table 11 Classification of Respondents with Respect to Preferance of Residancial Area: Rural, Semi-Urban, Urban and Any

	Rural	Semi - Urban	Urban	Any	Total
Infected	7	3	1	1	12
Non-infected	32	3	4	9	48
Total	39	6	5	10	60

Testing of Hypotheses:

$\mathbf{H_{01}}$: p = 0.5 against $\mathbf{H_{11}}$: p > 0.5 where,

p= Praportion of individuals preferring residance in Rural Area from all respondents.

$\mathbf{H_{02}}$: $p_1 = p_2$ against $\mathbf{H_{12}}$: $p_1 \neq p_2$ where,

p_1 = Praportion of respondents preferring residance in Rural Area in Infected class.

p_2 = Praportion of respondents preferring residance in Rural Area in Non-infected class.

Table 12

Table 12 Computation Summary for Testing H_{01} and H_{02} by using Data in Table 11

Hypothesis	Praportions	Z-Statistic	p-value
H_{01}	p = 0.6500	2.4360	0.0074
H_{02}	p_1 = 0.5833	-0.5418	0.5880
	p_2 = 0.6667		

Table 13

Table 13 Classification of Respondents with Respect to Transportation Frequency: Increased, Decreased and No any Change

	Increased	Decreased	No any change	Total
Infected	3	5	4	12
Non-infected	11	17	20	48
Total	14	22	24	60

Testing of Hypotheses:

$\mathbf{H_{01}}$: p = 0.5 against $\mathbf{H_{11}}$: p > 0.5 where,

p = Praportion of individuals with Decrease in Transportation Frequency from all respondents.

H_{02}: $p_1 = p_2$ against **H_{12}**: $p_1 \neq p_2$ where,

p_1 = Praportion of respondents with Decrease in Transportation Frequency in Infected class.

p_2 = Praportion of respondents with Decrease in Transportation Frequency in Non-infected class.

Table 14

Table 14 Computation Summary for Testing H_{01} and H_{02} by using Data in Table 13

Hypothesis	Praportions	Z-Statistic	p-value
H_{01}	p = 0.3667	–2.1426	0.9841
H_{02}	p_1 = 0.4167	0.4018	0.6878
	p_2 = 0.3542		

Table 15

Table 15 Classification of Respondents with Respect to Online Teaching-Learning Method: Excellent, Good, Mix Mode (Online and Offline) and Worst

	Excellent	Good	Mix	Worst	Total
Infected	1	3	6	2	12
Non-infected	15	17	10	6	48
Total	16	20	16	8	60

Testing of Hypotheses:

H_{01}: p = 0.5 against **H_{11}**: p > 0.5 where,

p = Praportion of individuals preferring online Teaching-Learning Method from all respondents.

H_{02}: $p_1 = p_2$ against **H_{12}**: $p_1 \neq p_2$ where,

p_1 = Praportion of respondents preferring online Teaching-Learning Method in Infected class.

p_2 = Praportion of respondents preferring online Teaching-Learning Method in Non-infected class.

Table 16

Table 16 Computation Summary for Testing H01 and H02 by using Data in Table 15

Hypothesis	Praportions	Z-Statistic	p-value
H_{01}	p = 0.8667	8.3567	0.0000
H_{02}	p_1 = 0.8333	-0.3801	0.7039
	p_2 = 0.8750		

3. OBSERVATIONS AND CONCLUSIONS

Observing computation summary given in Table 2, p–value = 1.0000, while testing $H_{01:}$ praportion of vegeterian individuals is equal to 0.5. Therefore, H_{01} is acceptable against its alternative that this praportion is more than 0.5. p–value = 0.2117, while testing $H_{02:}$ praportion of vegeterian individuals in infected and non-infected class are equal against its alternative that these praportions are not equal. Therefore, H_{02} is also acceptable against its alternative that these praportions are not equal.

So, we conclude that the proportion of individuals having their food habit is vegeterian in an entire population from where responses arrive is 0.5. Also, we conclude that the praportion of vegeterian individuals in an infected and non-infected categories are equal.

Observing computation summary given in Table 4, p–value = 0.0000, while testing $H_{01:}$ praportion of Yoga practicing individuals is equal to 0.5. Therefore, H_{01} is rejectable in favour of its alternative that this praportion is more than 0.5. p–value = 0.3864, while testing $H_{02:}$ praportion of Yoga practicing individuals in infected and non-infected class are equal against its alternative that these praportions are not equal. Therefore, H_{02} is acceptable against its alternative that these praportions are not equal.

So, we conclude that the proportion of Yoga practicing individuals in an entire population from where responses arrive is more than 0.5. Also, we conclude that the praportion of Yoga practicing individuals in an infected and non-infected categories are equal.

Observing computation summary given in Table 6, p–value = 0.0000, while testing $H_{01:}$ praportion of individuals doing physical exercise is equal to 0.5. Therefore, H_{01} is rejectable in favour of its alternative that this praportion is more than 0.5. p–value = 0.6150, while testing $H_{02:}$ praportion of individuals doing physical exercise in an infected and non-infected class are equal against its alternative that these praportions are not equal. Therefore, H_{02} is acceptable against its alternative that these praportions are not equal.

So, we conclude that the proportion of individuals doing physical exercise in an entire population from where responses arrive is more than 0.5. Also, we conclude that the praportion of individuals doing physical exercise in an infected and non-infected categories are equal.

Observing computation summary given in Table 8, p–value = 0.0161, while testing $H_{01:}$ praportion of individuals with increase in Health Consciousness is equal to 0.5. Therefore, H_{01} is rejectable in favour of its alternative that this praportion is more than 0.5 at 1.61% level of significance. p–value = 0.7939, while testing $H_{02:}$ praportion of individuals with increase in Health Consciousness in an infected and non-infected class are equal against its alternative that these praportions are not equal. Therefore, H_{02} is acceptable against its alternative that these praportions are not equal.

So, we conclude that the proportion of individuals with increase in Health Consciousness in an entire population from where responses arrive is more than 0.5. Also, we conclude that the praportion of individuals with increase in Health Consciousness in an infected and non-infected categories are equal.

Observing computation summary given in Table 10, p–value = 0.0000, while testing $H_{01:}$ praportion of individuals with Fear of Health or Income is equal to 0.5. Therefore, H_{01} is rejectable in favour of its alternative that this praportion is more than 0.5. p–value = 0.7473, while testing $H_{02:}$ praportion of individuals with Fear of Health or Income in an infected and non-infected class are equal against its alternative that these praportions are not equal. Therefore, H_{02} is acceptable against its alternative that these praportions are not equal.

So, we conclude that the proportion of individuals with Fear of Health or Income in an entire population from where responses arrive is more than 0.5. Also, we conclude that the praportion of individuals with Fear of Health or Income in an infected and non-infected categories are equal.

Observing computation summary given in Table 12, p–value = 0.0074, while testing $H_{01:}$ praportion of individuals preferring residance in Rural Area is equal to 0.5. Therefore, H_{01} is rejectable in favour of its alternative that this praportion is more than 0.5 at 0.74% level of significance. p–value = 0.5880, while testing $H_{02:}$ praportion of individuals preferring residance in Rural Area in an infected and non-infected class are equal against its alternative that these praportions are not equal. Therefore, H_{02} is acceptable against its alternative that these praportions are not equal.

So, we conclude that the proportion of individuals preferring residance in Rural Area in an entire population from where responses arrive is more than 0.5. Also, we conclude that the praportion of individuals preferring residance in Rural Area in an infected and non-infected categories are equal.

Observing computation summary given in Table 14, p–value = 0.9841, while testing $H_{01:}$ praportion of individuals with Decrease in Transportation Frequency is equal to 0.5. Therefore, H_{01} is acceptable against its alternative that this praportion is more than 0.5. p–value = 0.6878, while testing $H_{02:}$ praportion of individuals with Decrease in Transportation Frequency in an infected and non-infected class are equal against its alternative that these praportions are not equal. Therefore, H_{02} is also acceptable against its alternative that these praportions are not equal.

So, we conclude that the proportion of individuals with Decrease in Transportation Frequency in an entire population from where responses arrive is more than 0.5. Also, we conclude that the praportion of individuals with Decrease in Transportation Frequency in an infected and non-infected categories are equal.

Observing computation summary given in Table 16, p–value = 0.0000, while testing $H_{01:}$ praportion of individuals preferring online Teaching-Learning Method is equal to 0.5. Therefore, H_{01} is rejectable against its alternative that this praportion is more than 0.5. p–value = 0.7039, while testing $H_{02:}$ praportion of individuals preferring online Teaching-Learning Method in an infected and non-infected class are equal against its alternative that these praportions are not equal. Therefore, H_{02} is acceptable against its alternative that these praportions are not equal.

So, we conclude that the proportion of individuals preferring online Teaching-Learning Method in an entire population from where responses arrive is more than 0.5. Also, we conclude that the praportion of individuals preferring online Teaching-Learning Method in an infected and non-infected categories are equal.

CONFLICT OF INTERESTS

None.

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